Planting

SUMMARY OF INSTRUCTIONAL ACTIVITIES

Plant Structure & Function - page 2

- Students locate and study a flowering plant on their school grounds.
- Students describe the plant and label the parts of the plant.
- Students discuss pollination and plant adaptation.
- Students use the Plant Guide on the National Park Labs. web site to categorize plants by adaptation or structures.

Planting - page 6

- Students examine and describe for other students the adaptations of various indigenous plants.
- Students participate in the restoration of an area by planting native plants.

Habitat Restoration Around the World - page 9

- Students read articles about habitat restoration projects in other parts of the world.
- Students discuss articles and complete worksheets.

Planting - page 11

- Students examine and describe for other students the adaptations of various indigenous plants.
- Students learn more about the cultural uses of plants.
- Students participate in the restoration of an area by planting native plants.

Plant Quilt - page 13

- Students use the Plant Guide on the National Park Labs web site and additional resources to create a multicultural depiction of plants and plant uses.

Revegetation

To revegetate means to provide an area with new plant cover. In the Golden Gate National Recreation Area, revegetation usually refers to placing indigenous plants in areas from which park staff and volunteers have removed invasive, exotic plant species.

Why is it necessary for park staff to revegetate restoration sites? Why not just remove invasive plants and then let natural ecological processes revegetate the area gradually over time? Although this is the preferred option, it takes many years for an area to revegetate naturally. The site must be visited repeatedly to prevent the establishment of exotic, invasive species that may out-compete native seedlings. Additionally, many disturbed areas no longer have a native seedbank remaining in the soil. Growing plants in the nursery and introducing them into an area when they are relatively mature, or sowing seeds directly on-site, helps resource managers speed up the natural process. The indigenous plant community will reach a state of resiliency more quickly, and provide habitat for other members of the ecosystem. For example, by introducing mature silver lupine (Lupinus albifrons) to a site such as Milagra Ridge, park staff are able to provide much-needed habitat for the endangered Mission Blue butterfly.

REVEGETATION METHODS

Planting and direct seeding are the two methods used in the park to revegetate restoration areas. Planting involves transplanting seedlings that have been raised in the nursery and are already relatively mature. Direct seeding entails sowing seeds on-site and letting them germinate and develop naturally.

Propagules (seeds and cuttings) for propagating plants at the nursery or for direct seeding are gathered from the restoration site or from the immediate area. It is preferable to collect propagules as close to the site as possible because the genotype (genetic makeup) of plants can change within a very short distance. Sometimes seeds or cuttings of the required species are not available in the immediate area and must be gathered from farther away. As a general rule, however, it is best to gather the propagules within the boundaries of the watershed in which the restoration site is located.

Plant Structure & Function

SUMMARY
Students draw and label the parts of a flowering plant. They use the Plant Guide on the National Park Labs web page to compare and group plants according to the plants' adaptations.

TIME
100 minutes

MATERIALS
- Computers with Internet access
- Planting Worksheet #1

Lesson

Day 1

Students locate flowering plants on or near their school grounds.

Students examine the plant and describe the texture and color of the leaves, stem, and petals.

Students draw the parts of the flowering plant, including each of the following structures:
a. Roots
b. Stem
c. Sepals
d. Petals
e. Pistil (stigma, style and ovaries)
f. Stamen (filament and anther)

Students complete the Planting Worksheet #1 by labeling the parts of the flowering plant, matching the parts with their functions, and describing the process of pollination.

Teacher leads a discussion about flowering plants:

- What role do insects play in the process of pollination?
- What type of insects might visit your plant for food? Why?
- How do leaves help you determine which plants use a lot of water?
- How have flowering plants adapted to survive?

Students access the National Park Labs web site (www.nps.gov/goga/parklabs) and find the Plant Guide.

Students create a chart that categorizes and sorts the plants in the Plant Guide.

Students create their own categories and organization for the chart, using at least five different categories.

Planting Worksheet #1

Directions:
1. Locate a flowering plant near your school. Examine the textures and colors of the leaves, stem and petals of the plant. Complete the following.

a. Draw and label the plant in the box below.
b. Match the part with its function on the left.

_____
where photosynthesis occurs

_____
develops into a fruit

_____
absorb nutrients

_____
receives pollen

_____
supports the flowers and leaves

_____
protects flower buds

_____
supports the anther

_____
attract insects with color

_____
connects the stigma and ovary

_____
releases the pollen

2. Describe the process of pollination in detail.

_____

_____

Planting Worksheet #2

Directions: Go to Golden Gate National Recreation Area's National Park Labs web site: www.nps.gov/goga/parklabs. Locate the section titled Plant Guide and complete the following:

1. Create a chart below that categorizes and sorts the plants in the Plant Guide. Use at least 5 categories.
2. Explain how and why you chose the categories.

2. Write two questions about plant adaptation.

_____

_____

_____

Planting

SUMMARY
Students study adaptations of plants and compare and contrast the essential functions that these adaptations serve. Students plant a restoration site.

TIME
4 hours

MATERIALS
- Picks
- Gloves
- Restoration Cycle (visual aid)
- Planting Worksheet #3
- GGNRA Work Performed Data Sheet

Program

Welcome
Park staff welcome students to the park. Using the Restoration Cycle visual aid, park staff ask the students to point out what step in the restoration cycle they think they will perform today. Park staff explain the planting project. They ask the students why revegetation is important. (The hope is that after establishing an indigenous plant community, various native animals will return, including many birds, insects, frogs and butterflies.)

Spread Plants
Students are introduced to the species that their group will be planting. Park staff explain the basics of plant spacing and ask the students to work in pairs to properly space the plants throughout the planting area.

Planting
Park staff give a planting demonstration and explain pick safety rules. Plants can survive rough handling but will always respond better if handled with care. Transplanting can disturb root systems; roots are the principal pathways by which plants take up water and nutrients, and any damage to the fragile root hairs will reduce the plant's ability to feed itself. Once planted in its natural habitat, the plant will not be watered or given fertilizer. Therefore, the bigger and healthier the root system, the better the plant will be able to remove water and nutrients available in the soil. One moment of rough or poor handling can ruin months of careful preparatory work in the nursery!

Students and staff plant. Staff facilitates a discussion. Include the following questions: Which step in the water cycle does fog represent? Condensation. How do plants fit into the water cycle? Transpiration through stomata. How does the weather and climate affect plants? How can a plant protect itself from wind? How can a plant protect itself during drought periods? How have plant roots adapted to the local climate? Why are we planting at this time of year? Once planted in its natural habitat, the plant will not be watered or given fertilizer. The rainy season provides the plants with needed moisture.

GGNRA Work Performed Data Sheet

Each group completes the GGNRA Work Performed Data Sheet. Students complete sections of Planting Worksheet #3 at each station.

Conclusion

Staff and students form a circle.

Staff review adaptations and functions with the class, emphasizing that different adaptations serve the same function for different plants. All plants have some method to regulate water loss, protect themselves from weather and insects, and disperse their seeds.

Park staff thank the class for their hard work during the planting.

Planting Worksheet #3

Directions: Complete the section for each station at the field session at Milagra Ridge. Formulate at least one question at the end of each station.

STATION 1

4. What is the total number of individual plants planted by your group? _____

5. Write at least one question about plant adaptations.

_____

_____

_____

STATION 2

4. What is the total number of individual plants planted by your group? _____

5. Write at least one question about plant revegetation methods.

_____

_____

_____

STATION 3

4. Record the length and width of the planting site. _____

5. Complete the work performed data sheet at your final station.

6. Write at least one question about the future of this site.

_____

_____

_____

Habitat Restoration Around the World

SUMMARY
Students are introduced to habitat restoration projects around the world. They compare these projects with each other, and with the restoration projects in Golden Gate National Recreation Area. They address the relationship of the Endangered Species Act to each project. They design a set of questions and recommendations for a restoration project manager to consider.

TIME
100 minutes

MATERIALS
- Four articles on restoration projects (These can be found using a simple Internet search.)
- Planting Worksheet #4

Lesson

Teacher explains to the class that the park restoration project they have been working on fits into a much larger picture of restoration projects worldwide. Today students will learn about some other restoration projects and have a chance to compare Golden Gate National Recreation Area's restoration project to the others. Each student is given one of the four articles on restoration projects.

Students read their articles. After reading the articles, students divide into groups by article. In their groups, students discuss their article and answer questions 1 to 8.

Students "jigsaw": Form new groups of four in which one representative from each of the original groups is present in the new group. In the new groups, students present the restoration project they read about. Students answer questions 9 to 11.

The class comes together. They discuss the purpose of restoration. In Golden Gate National Recreation Area, the goal of restoration is to increase plant and animal diversity, and protect Endangered species. Is this a valid goal? How does it compare to the goals of the other restoration projects? Considering other environmental challenges, how important is restoration? Who benefits from restoration of natural areas?

Planting Worksheet #4
Restoration Around the World

TO BE DISCUSSED IN FIRST GROUP:

1. What is the goal of this restoration project?

2. Who or what will benefit from this project, if successful?

3. Does this project benefit people of all economic classes? Why or why not?

4. Who is sponsoring or funding this restoration work?

5. Does this project show collaboration between interest groups or is it a one-sided effort?

6. Who might be against this project? Who or what does it affect negatively?

7. How does this project approach endangered species and their protection?

8. What is your opinion of this project?

TO BE DISCUSSED IN SECOND GROUP:

8. Do you think one of these projects is more important or valuable than another?

9. If you had to choose only two of the four projects, which two would you choose? Why?

10. Compare these projects to the restoration project you have been working on in the Golden Gate National Recreation Area. Which is more valuable? Why?

Planting

SUMMARY
Students study adaptations of plants and compare and contrast the essential functions that these adaptations serve. Students plant a restoration site.

Program

Students cycle through three stations. Students engage in similar planting activities as in earlier visit to Milagra Ridge. They discuss cultural uses of plants. They complete Planting Worksheet #5 at each station.

Planting Worksheet #5

Directions: Complete the section for each station at the field session at Milagra Ridge. Formulate at least one question at the end of each station.

STATION 1

1. What is the total number of individual plants planted by your group? _____

2. Write at least one question about cultural views.

_____

_____

_____

STATION 2

1. What is the total number of individual plants planted by your group? _____

2. Write at least one question about cultural uses of plants.

_____

_____

_____

STATION 3

1. Record the length and width of the planting site. _____

2. Complete the work performed data sheet at your final station.

3. Write at least one question about this restoration project.

_____

_____

_____

Plant Quilt

SUMMARY

Using the Plant Guide on the National Park Labs web site and additional research, students create a "quilt" depicting different ways cultures view and use plants.

TIME

50 minutes on Day 1
35 minutes on Day 2

MATERIALS

- Old magazines
- Glue
- Scissors
- Tape
- 12" x 12" squares of white paper
- 14" x 14" squares of construction paper (various colors)
- Computers with internet access
- Additional research material on cultural uses of plants

Program

Day 1

Students brainstorm about how different cultures view and use plants. (For some cultures, certain plants are food or medicine while for others they are not. Some cultures use plants ornamentally; some use them for religious ceremonies. Plants that are considered weeds for some people are desirable for others.) Teacher prompts the students to think about plants from various viewpoints.

Students divide into small groups. Each group receives a piece of the white paper. Using images and ideas from the National Park Labs web site, the resource material, and the magazines, they begin creating a quilt square depicting what they understand as one culture's view of a particular plant.

Students clean up; teacher tells them that they must be ready with their quilt square by the beginning of the next class session.

Day 2

Each group glues its completed quilt square onto a piece of the construction paper.

The entire class places the squares together in the shape of a quilt. Once the class agrees on the arrangement of the squares, the class tapes the squares together.

The class hangs the quilt on the classroom wall. Each group describes its square to the other students.